VIDEO MONITOR

USER'S MANUAL

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MED Associates, Inc.
P.O. Box 319
St. Albans, Vermont 05478
www.med-associates.com

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CHAPTER 1
Introduction

The MED Associates Video Monitor System is a video display/recording and computer system designed to allow researchers to monitor animal behavior during experimentation. Cameras can be mounted inside animal cubicles, giving the researcher a clear view of the animal's activities without disturbing the animal. A variety of cameras and lenses are available to satisfy most viewing requirements. Video Monitoring System integrates with MED-PC®, allowing MED-PC to control the starting and stopping of the video, and allowing MED-PC to insert comments into the saved video files. For example, when an animal receives a reward, MED-PC can insert the text "Reward pellet given" into the video file, allowing for accurate timing of when events happen inside a video file. Video Monitoring System supports a variety of camera modes, resolution, and frame rates.

General Computer Environment

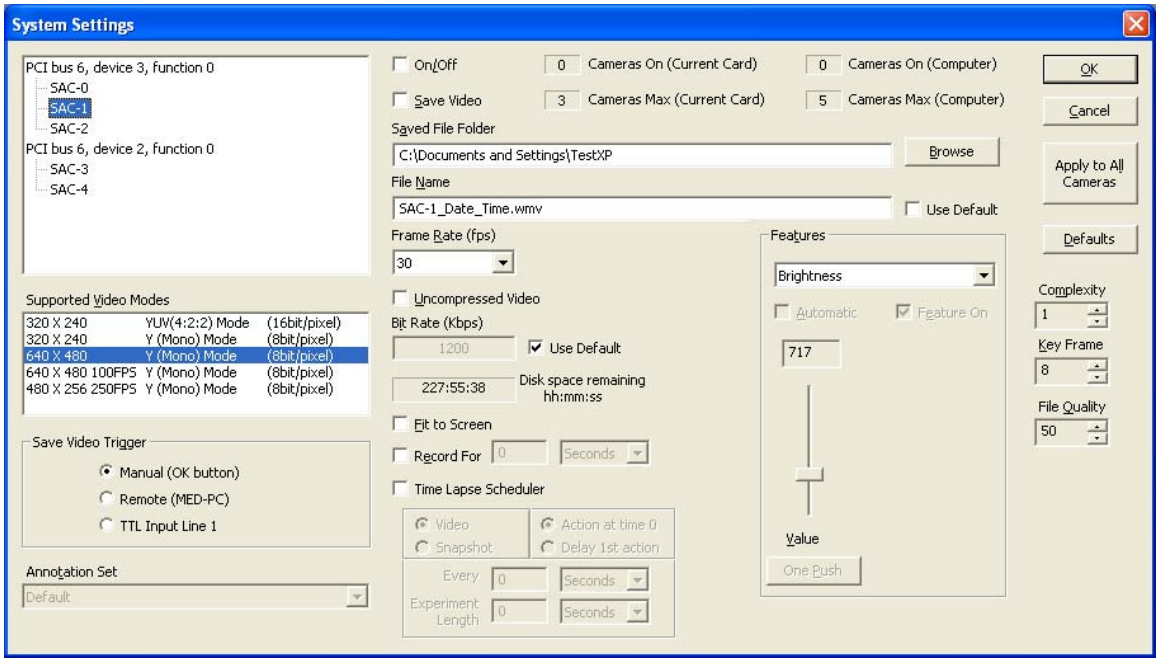
- 3.4GHz Processor
- 1GB RAM
- Windows™ 2000 SP4, XP or Vista (32-bit only)
- Fire Wire Card
- Fire Wire Camera(s)

CHAPTER 2
Interface Reference

This chapter describes the important dialogs and screens of the Video Monitor Software. For a discussion of how to use Video Monitor, refer to the **Using Video Monitor** section of this manual.

System Settings Dialog

Figure 2-1 - System Settings Dialog (showing optional and advanced features)



Camera Tree

At the upper left of the System Settings dialog is a tree control similar to Windows Explorer's folder view pane. The tree displays two levels of hardware configured and attached to the system. The upper level shows FireWire cards, and the lower level displays cameras attached to that card. To expand a FireWire card to display its connected cameras, double click with the mouse or press the keyboard "**+**" key. To collapse a card and hide its cameras, double click with the mouse or press the keyboard "**-**" key.

Clicking the left mouse button on a FireWire card will cause most fields on the System Settings Dialog to be disabled, because they display camera specific information. The **Cameras On** and **Cameras Max** fields, however, are applicable at the FireWire card level. Clicking on a camera will cause the remaining fields on the dialog to display information unique to that camera. If a camera is plugged in and does not appear in the tree, first be sure the card is expanded. Then refer to the **Installing & Configuring Hardware** section of this manual.

Renaming a Camera

To rename a camera, select the camera in the tree. Either click on the camera again with the left mouse button, or use the right mouse button to bring up the context menu and choose **Rename**.

On/Off

If the **On/Off** field is checked (On), the camera selected in the Camera Tree control will be shown when the System Settings dialog is closed. An image stream from each "On" camera will be displayed in its own window when the OK button is pressed.

Save Video

If the **Save Video** field is checked, the camera selected in the Camera Tree control will have video recorded to disk. If the Save Video field is checked, the On/Off field must also be filled to record video. The video file will be saved under the filename displayed in the File Name field, and in the directory in the Saved File Folder field.

Cameras On (Current Card) / Max Cameras (Current Card)

Cameras On (Current Card) displays the number of cameras that are turned on for the FireWire card currently active in the Camera Tree control. When the **OK** button is pressed, and the System Settings dialog is closed, each "on" camera will have it's video stream displayed. **Cameras Max (Current Card)** shows the maximum number of cameras that may be activated on that FireWire card. Cameras Max (Current Card) will never be greater than the number of cameras successfully attached to the FireWire card selected in the tree control.

Cameras On (Computer) / Max Cameras (Computer)

The **Cameras On (Computer)** displays the number of cameras "on" for the entire system. For systems with only one FireWire card installed, this number will be the same as the Cameras On (Current Card) field. **Max Cameras (Computer)** displays the cumulative total of the Cameras Max (Current Card) values from each FireWire card.

Saved File Folder / Browse

Video or snapshots for the camera selected in the tree control will be saved in this directory. Use the Browse button or type in a valid directory name.

File Name / Use Default

Video files will be saved with this filename. The keywords "**_Date**" and "**_Time**" (without quotes) will be expanded to the date and time that the video was started. The date will be in format DDMonYYYY, time as HH-MM-SS. For example, if the File Name field is "RatCage1_Date_Time.wmv", and the video starts at 4:13:22 PM on September 23, 2006, the saved file will be called "RatCage1_23Sep2006_16-13-22.wmv".

Press the Use Default button to have a filename automatically created in the format: CameraName_Date_Time. In the example above, the camera name is "RatCage1".

Supported Video Modes

Video Monitor supports the following video formats and associated frame rates:

PIXEL RESOLUTION	DESCRIPTION	FRAME RATES (fps)
160 x 120	YUV (4:4:4) Mode (24 bit/pixel)	7.5, 15, 30
320 x 240	YUV (4:4:2) Mode (16 bit/pixel)	3.75, 7.5, 15, 30
640 x 480	YUV (4:1:1) Mode (12 bit/pixel)	3.75, 7.5, 15, 30
640 x 480	YUV (4:2:2) Mode (16 bit/pixel)	3.75, 7.5, 15, 30
640 X 480	RGB Mode (24bit/pixel)	3.75, 7.5, 15, 30
640 X 480	Y (Mono) Mode (8bit/pixel)	3.75, 7.5, 15, 30, 60
640 X 480	Y (Mono16) Mode (16bit/pixel)	3.75, 7.5, 15, 30
800 X 600	YUV (4:2:2) Mode (16bit/pixel)	3.75, 7.5, 15, 30
800 X 600	RGB Mode (24bit/pixel)	7.5, 15
800 X 600	Y (Mono) Mode (8bit/pixel)	7.5, 15, 30, 60
1024 X 768	YUV (4:2:2) Mode (16bit/pixel)	1.875, 3.75, 7.5, 15
1024 X 768	RGB Mode (24bit/pixel)	1.875, 3.75, 7.5
1024 X 768	Y (Mono) Mode (8bit/pixel)	1.875, 3.75, 7.5, 15, 30
800 X 600	Y (Mono16) Mode (16bit/pixel)	3.75, 7.5, 15, 30
1024 X 768	Y (Mono16) Mode (16bit/pixel)	1.875, 3.75, 7.5, 15
1280 X 960	YUV (4:2:2) Mode (16bit/pixel)	1.875, 3.75, 7.5
1280 X 960	RGB Mode (24bit/pixel)	1.875, 3.75, 7.5, 15
1280 X 960	Y (Mono) Mode (8bit/pixel)	1.875, 3.75, 7.5, 15
1600 X 1200	YUV (4:2:2) Mode (16bit/pixel)	1.875, 3.75, 7.5
1600 X 1200	RGB Mode (24bit/pixel)	1.875, 3.75
1600 X 1200	Y (Mono) Mode (8bit/pixel)	1.875, 3.75, 7.5, 15
1280 X 960	Y (Mono16) Mode (16bit/pixel)	1.875, 3.75, 7.5
1600X 1200	Y (Mono16) Mode (16bit/pixel)	1.875, 3.75, 7.5
640 X 480	Y (Mono) Mode (8 bit/pixel)	100
480 X 256	Y (Mono) Mode (8 bit/pixel)	250

NOTE: All cameras do not provide all modes supported by Video Monitor. The specific video formats and frame rates available will vary depending on which camera(s) you are using with your Video Monitor system.

Save Video Trigger

The trigger mechanism for saving video can be manually controlled, or from MED-PC, or (on some cameras) a TTL pulse.

- **Manual:** video will begin recording when the **OK** button is pressed on the System Settings dialog, if the Save Video checkbox is filled.
- **Remote:** the save video trigger will be sent from MED-PC script language. When the System Settings OK button is pressed, the camera's video stream will be shown in a window with "Waiting for remote trigger…" in the title bar. Video saving will start when commanded by MED-PC. For more details, refer to the section: **Trigger from MED-PC**.

Optional Save Video Trigger

- **TTL Input Line 1:** video saving starts when the camera's TTL input line 1 goes high. As with the Remote setting, the camera's video stream will be shown in a window titled "Waiting for remote trigger…" when the System Settings dialog OK button is pressed. TTL High is 3.5 to 5 VDC; TTL Low is 0.0 to 0.4 VDC. All cameras do not support this feature. Triggering video recording via TTL Input directly to the camera is an optional accessory to Video Monitor.

NOTE: Do not confuse the Save Video Trigger described here with the "Trigger" option in the Features section of the System Settings dialog. The Features section Trigger refers to externally controlling each frame's capture via a TTL pulse on input line 0. See the **Camera Features** section below for more on the frame rate Trigger setting.

Annotation Set

When recording video or playing back a video using the Video Monitor player, text can be added to the video file and stored in the resulting .wmv file. When the video is played back, the text will appear as closed captions, with the timestamp and text. This text is added to the video file using the Annotation Toolbar in the playback and recorder windows. The Annotation Toolbar will show a set of text strings defined as an Annotation Set. To choose which Annotation Set to show in the Annotation Toolbar with the camera stream during recording, select the desired set in the Annotation Set list box.

To add or delete Annotation Sets, choose "Add / Delete Annotation Set" from the list box. For more information on creating Annotation Sets, see section "Add/Delete Annotation Set".

Frame Rate

Based on the Video Mode selected, various frame rates are available. The frame rates listed are in units of frames per second. A higher frame rate will require more processor resources and hard drive space. It is important to note that if the frame rate setting is higher than 60 fps, it may be necessary to save the video as uncompressed.

If a hardware frame trigger is used (Features section, Trigger option, Feature On checked) the trigger rate must be entered. The Frame Rate list box will be disabled, and an edit box labeled "Ext. Trig. Rate" will be shown. Enter the trigger rate in frames per second so the playback window knows which speed to play the video.

Uncompressed Video

Clicking this check box disables the compression routine while saving to disk. This will yield very large files, and should only be used for short duration videos. The uncompressed video option is intended for high (>60 fps) frame rate videos, where the compression algorithm might not be fast enough to keep up with the incoming video.

Bit Rate

When saving video to disk, the video stream data is compressed to conserve storage space. The recommended video compression ratio is 120:1. This is an approximate value; the requirements for video quality and disk space may differ. To calculate the bit rate for your video format and frame rate, use the following formula:

*width * height * bits per pixel * frames per second / 1024 / 120 = bitrate (kbps)*

Where "*width*" and "*height*" are the frame size in pixels, and "*bits per pixel*" is essentially the color resolution of the image format. "*Frames per second*" is the camera recording rate. "1024" is the number of bits per kilobit, and "120" is the recommended data acquisition to storage ratio.

For example: a 640 * 480 pixel, 16 bpp format image at 30 frames per second should use a bit rate of 1200 kbps.

640 * 480 * 16 * 30 / 1024 / 120 = 1200 kbps

If the bit rate is too low, the processor will not be able to keep up with the video stream, and video frames will be dropped. For this reason, it is recommended that the default bit rate or higher be used.

Disk Space Remaining

The amount of hard drive space available in the "Saved File Folder" drive will be displayed in hours : minutes : seconds format.

Fit to Screen

Fill this checkbox if it is desired to have the video image fill the camera window client area. If this checkbox is clear, the image will be shown in the recorded format. For example, a 640 * 480 image would be shown as 640 pixels wide by 480 pixels high, regardless of the size of the camera window. When viewing multiple tiled cameras at once, Fit to Screen is useful, sacrificing proper image spatial relation in favor of seeing the entire video image.

Record For

To record video for a specific amount of time, fill the Record For check box, and enter the video length in seconds, minutes, or hours. The "Save Video" check box should also be filled.

Time Lapse Scheduler

To activate the Time Lapse Scheduler section, fill the Time Lapse Scheduler check box. The Time Lapse Scheduler provides the ability to have videos or still shots recorded at specific intervals. For more information on using the Time Lapse Scheduler, see the "Time Lapse Scheduler" section below.

Complexity (Advanced Configuration)

Complexity is only shown with the command line switch **/advconfig** specified at program startup. Valid values are 1, 2, 3, or 4. This value specifies the level of compression algorithm complexity. A higher level of complexity will demand more processor usage, and yield a better-looking video image. For most purposes, level 1 is appropriate.

Key Frame (Advanced Configuration)

Key Frame is only shown with the command line switch **/advconfig** specified at program startup. The Key Frame value is maximum number of seconds between key frames in the saved video (*.wmv) file. Normally this value is eight seconds.

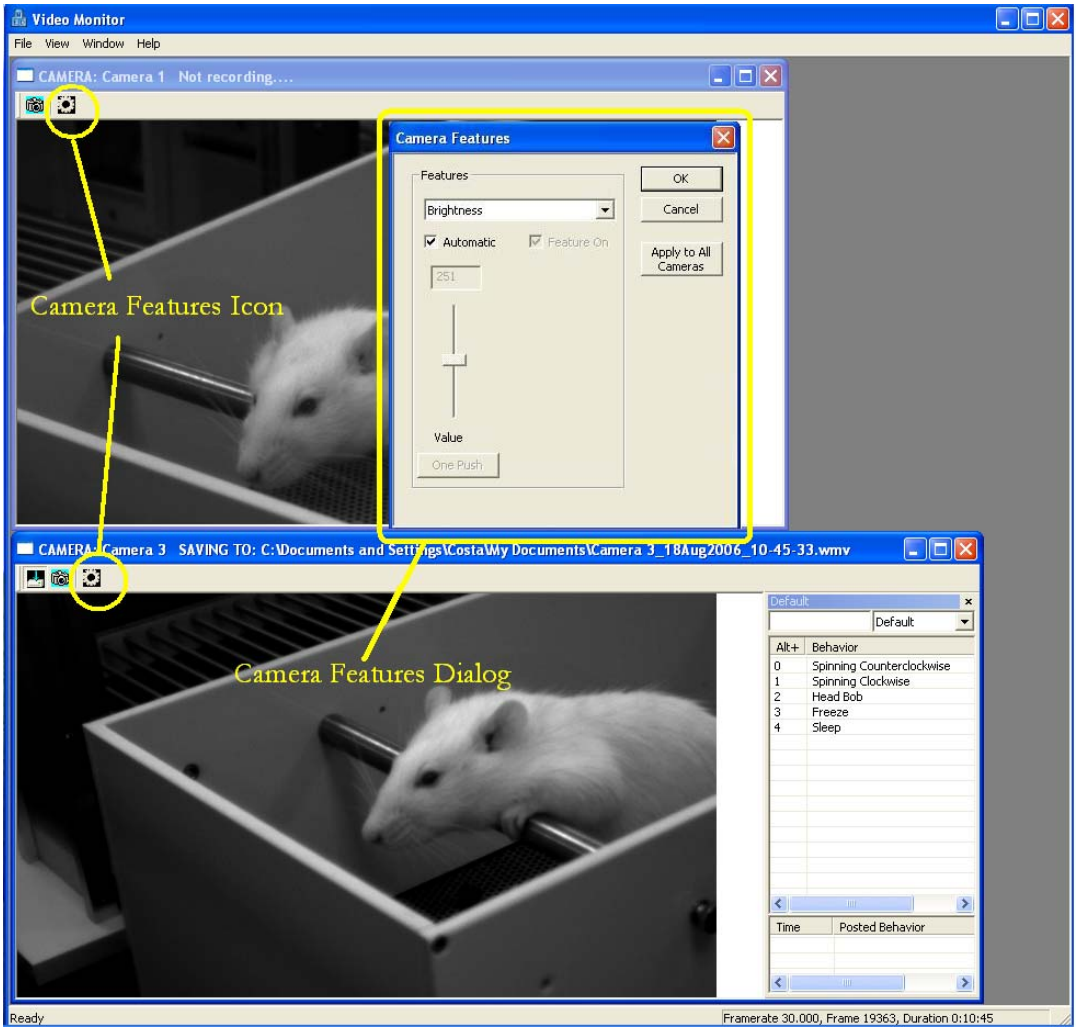
File Quality (Advanced Configuration)

File Quality is only shown with the command line switch **/advconfig** specified at program startup. Valid values are integers, 0-100. Similar to Complexity, a higher value will require more processor resources and yield a better-looking video image. Default value is 50.

Camera Features

The camera features section allows the user to alter imaging components. The options vary by camera model. The camera features may also be adjusted during runtime by clicking the Camera Features icon in the camera window toolbar.

Figure 2-2 - Camera Features Icon and Dialog



As a general rule, set all features to **Automatic**, if available, as a first step in creating a sharp, clear picture. During live video playback of a typical camera in a multi-camera setup, adjust one feature at a time. Once satisfied, if all cameras are the same make and model, press the **Apply to All Cameras** button. Some fine-tuning of individual cameras may still be necessary due to slight camera, lighting, environment, and subject differences.

Most video cameras support the following features:

- Brightness – adjusts the black level of the camera.
- Auto Exposure – allows the camera to control exposure time.
- Sharpness – affects the clarity of detail in an image.
- White Balance – calibrates a camera's color response to take into account different "color temperatures" of light (i.e., fluorescent light is greenish; sunlight, more blue; incandescent light, yellowish). This calibration allows the camera to define what the color white is under any of these various lighting conditions.
- Saturation - the saturation of a color is the degree to which the color departs from neutral gray of the same brightness. An attribute of perceived color, or the percentage of hue in a color. Saturated colors are called vivid, strong, or deep.
- Gamma - allows application of a non-linear response curve. One thing that a user may notice when adjusting the gamma is a grayish film in the resulting image (i.e. image appears washed out). This is generally a result of the Gamma being set too high.
- Shutter – somewhat camera dependent, but generally sets the time between images captured. Some camera types implement this differently, and hardware differences at the digital image sensor level mean that some cameras can create clearer images at faster refresh rates than others.

NOTE: for cameras operating under format 7 (partial image format / high speed frame rates of greater than 60 fps), the Shutter setting will affect the frame rate. For this reason, the Shutter control setting is automatically controlled by the Video Monitor software when operating in format 7 and using an external hardware trigger (TTL pulse). Otherwise, adjusting the shutter rate while saving video would result in a variable frame rate with unpredictable playback.

- Gain – a multiplier for the camera sensor signal output.
- Trigger – some cameras allow the frame capture timing to be externally controlled. In normal operating mode (Features Trigger **off**) the camera is set to operate at a particular frame rate, for example, 30 fps (frames per second). The camera then is responsible for capturing images at that rate. With the Features Trigger **on**, the camera waits for an externally generated TTL pulse on its input line 0 to signal the capture of each frame.

NOTE: The Features section "Trigger" is much different than the options in the Save Video Trigger section. Those settings refer to the source of the save video start command, where the Features Trigger refers to the source of the frame exposure command.

"Polarity" is camera dependent, but refers to whether the camera exposure is triggered on the rising or falling edge of the TTL trigger signal. MOST cameras use a "low active" configuration, meaning that when the Polarity checkbox is cleared (default), the camera will trigger on the falling edge of the TTL pulse. Conversely, if the checkbox is filled, the exposure will start on the rising TLL pulse edge.

When using the Trigger feature, Video Monitor will automatically control the shutter rate, and the Shutter option will not be shown on the Features dialog when launched from the camera window's toolbar. The reason is if the shutter rate was slowed beyond the exposure cycle time, the desired frame rate could not be achieved.

Currently, only 640 x 480 resolution, with a maximum of 104 frames per second external trigger rate is supported. Minimum external trigger rate is 1 frame per 15 minutes. TTL "High" voltage is 3.5 – 5 VDC. TTL "Low" voltage is 0 – 0.4 VDC. The frame trigger channel is input port 0.

Apply To All Cameras

Once all of a camera's features and settings are customized, these settings can be copied to other cameras. This is a time saving feature when working with multiple cameras of the same make and model, which are operating in similar lighting situations, and observing similar subjects. The other cameras in the camera tree will copy the following settings:

- Camera On/Off
- Save On/Off
- Save Directory (but NOT file name)
- Bit Rate (if Use Default Bit Rate is ON, default is calculated)
- Frame Rate (fps) (if available)
- Fit To Screen
- Complexity
- File Quality
- Key Frame Spacing
- Record Time
- Use Remote Saving
- Format / Mode (if available on destination camera)
- Time Lapse Scheduler
  - On/Off
  - Video / Snapshot
  - Action at Time 0 / Delay 1st Action
  - Every X Time
  - Experiment Length Time
- Feature Settings (if available on destination camera)
  - Brightness - Auto (on/off) / Value (number)
  - Exposure - Auto / Value
  - Sharpness - Auto / Value
  - White Balance - Auto / Value 1 / Value 2
  - Hue - Auto / Value
  - Saturation - Auto / Value
  - Gamma - Auto / Value
  - Shutter - Auto / Value
  - Gain – Auto / Value
  - Iris – Auto / Value
  - Focus – Auto / Value
  - Temperature – Auto / Value 1 / Value 2
  - Trigger – On / Polarity / Mode / Parameter
  - Zoom – Auto / Value
  - Pan – Auto / Value
  - Tilt – Auto / Value

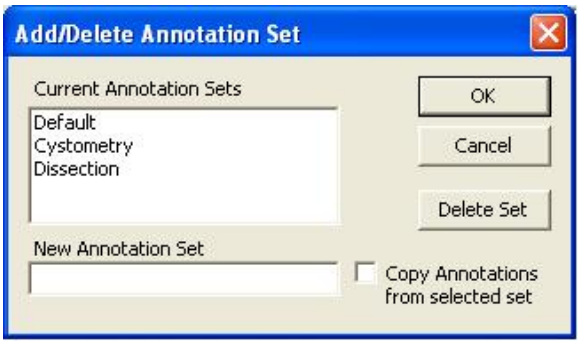
Defaults

Click this button to load the default values for this camera. The default values cover the fields:

- Format
- Mode
- Frame Rate (fps)
- Brightness - Auto / Value
- Exposure - Auto / Value
- Sharpness - Auto / Value
- White Balance - Auto / Value1 / Value2
- Hue - Auto / Value
- Saturation - Auto / Value
- Gamma - Auto / Value
- Shutter - Auto / Value
- Gain - Auto / Value
- Iris - Auto / Value
- Focus - Auto / Value
- Temperature - Auto / Value1 / Value2
- Trigger - On / Polarity / Mode / Parameter
- Zoom - Auto / Value
- Pan - Auto / Value
- Tilt - Auto / Value
- Fit To Screen
- File Quality
- Bit Rate
- Key Frame Spacing
- Complexity
- Use Remote Saving
- Time Lapse Scheduler Settings

Add/Delete Annotation Set

Figure 2-3 - Add/Delete Annotation Set



When recording or playing a video, the annotation toolbar can be used to add text notes to the video file. These annotations can be viewed using Media Player by turning on Closed Captioning. Groups of annotations are called **Annotation Sets**. To create a new annotation set, or delete an existing set, select **Add/Delete Annotation Set** from the **Annotation Set** list box on the System Settings dialog. The dialog above will appear.

To create a new set, type the name in the **New Annotation Set** edit field. If you wish to initially populate the text fields of the annotation set with those of an existing set, check the **Copy Annotations from Selected Set** field, and highlight a field in the **Current Annotation Sets** list box.

To delete an Annotation Set, select the set in the **Current Annotation Sets** list box, and click the **Delete Set** button.

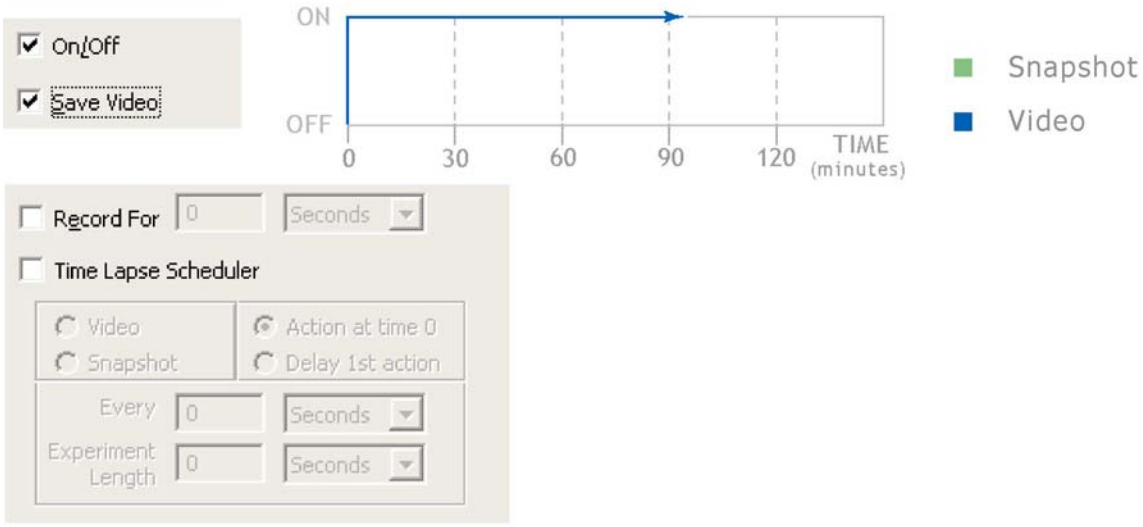
For information on adding and removing text strings to the Annotation Set, see the "Annotation Toolbar" section later in this manual.

Time Lapse Scheduler

The **Time Lapse Scheduler** provides the ability to record video segments or take snapshots at specific intervals. Used in conjunction with the **Record For** feature, this provides a very flexible means of recording images. In the table below, five different recording examples are explained. The table shows the settings of the Save Video, Record For, and Time Lapse Scheduler check boxes, the Video / Snapshot radio setting, and the Record For, Every, and Experiment Length time settings.

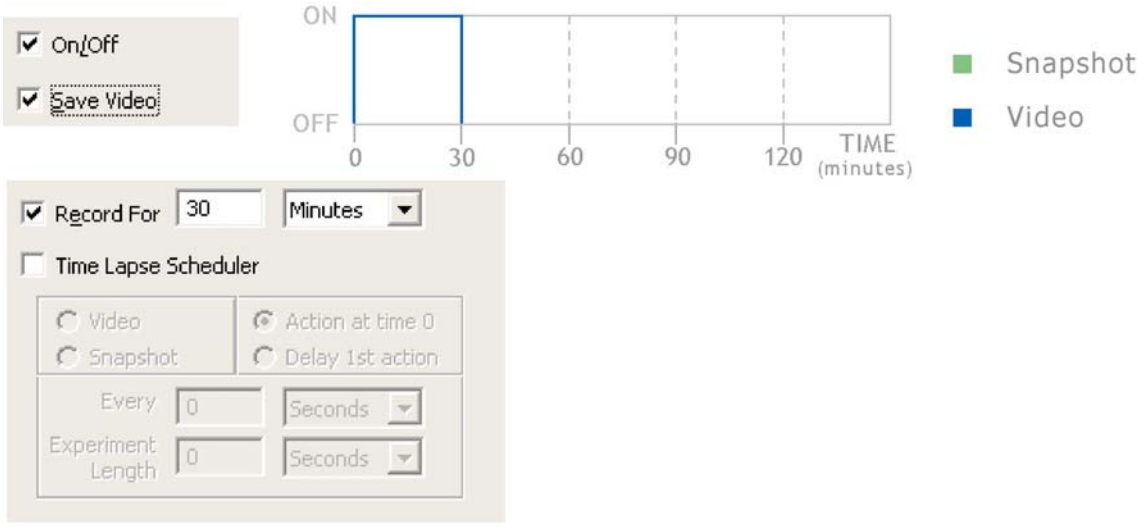
In Example A, the video stream is recorded until the user closes the camera window, or presses the Start/Stop Saving video button in the camera window toolbar.

Figure 2-4 - Example A



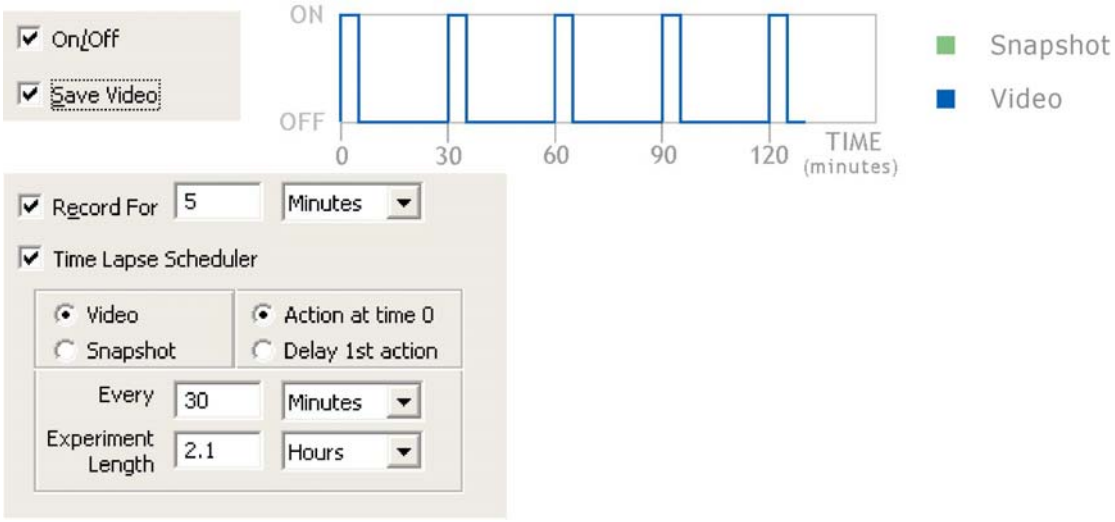
In Example B, a video is recorded for 30 minutes.

Figure 2-5 - Example B



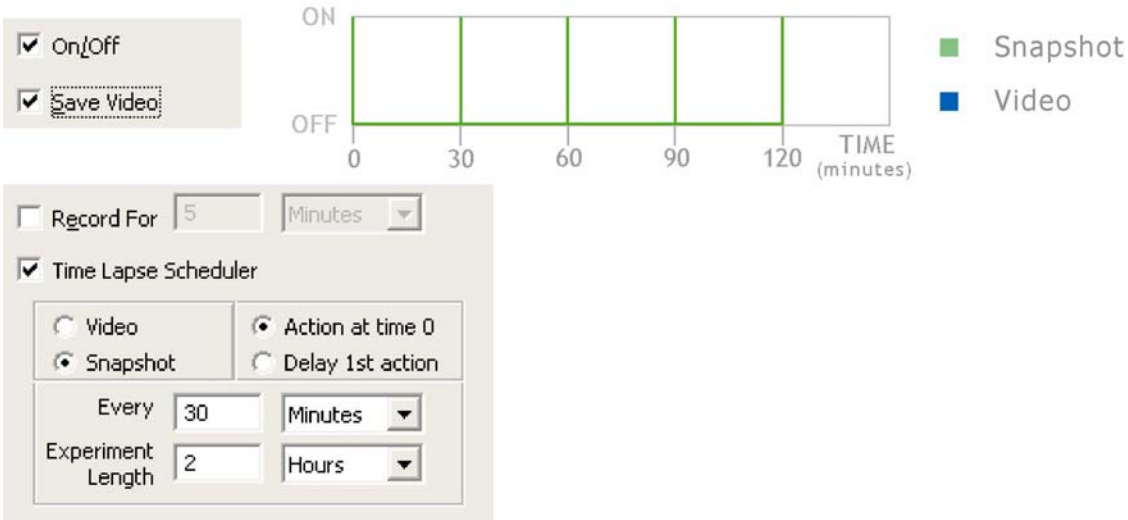
In Example C, a 5-minute video segment is recorded every 30 minutes for 2.1 hours. The result is a single video file (*.wmv) with 5-minute video segments separated by a blue screen, and each segment start is annotated. There will be five video segments in the video file if **Action at Time 0** is selected (as shown in Figure 2-6), or four video segments if **Delay 1st action** is selected.

Figure 2-6 - Example C



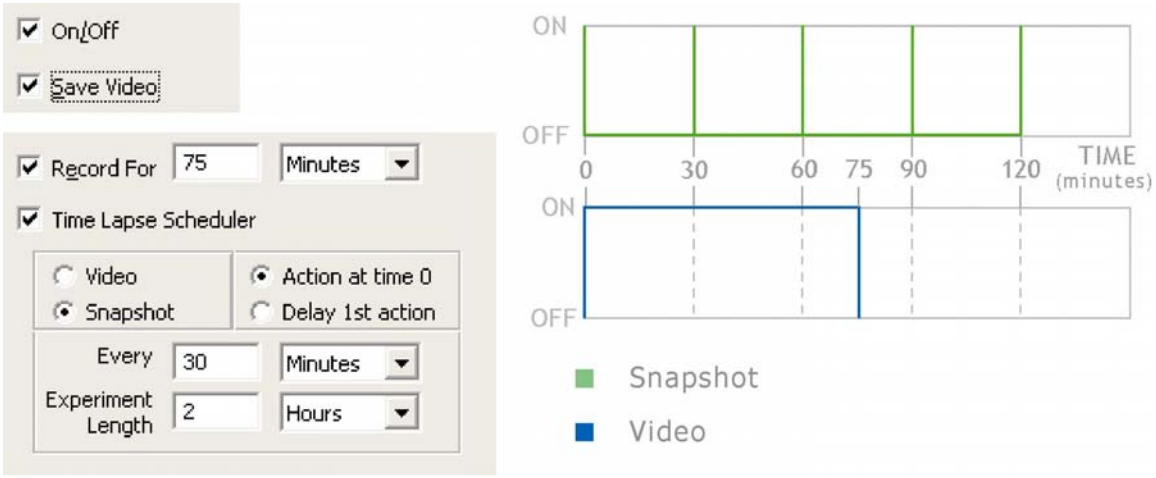
In Example D, a snapshot is taken every 30 minutes for 2 hours. The snapshots will be saved as bitmap (*.bmp) files, and named as "CameraName_####.bmp", where "CameraName" is the name of the camera in the tree control and #### is the lowest available number.

Figure 2-7 - Example D



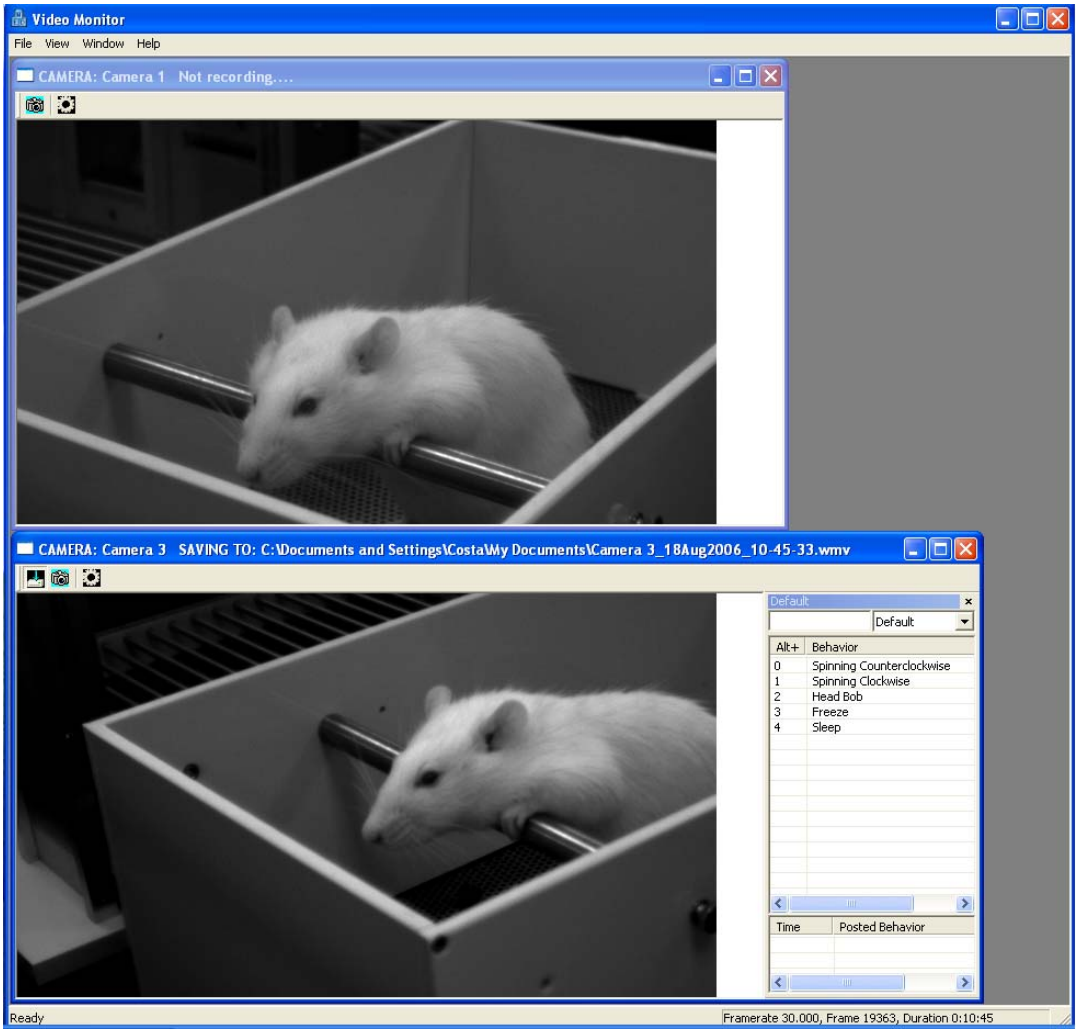
In Example E, video is recorded for 75 minutes, and snapshots are taken every 30 minutes for 2 hours. And as in Examples C and D, the number of snapshots taken in Example E will be five if **Action at Time 0** is selected (as shown in Figure 2-8), or four if **Delay 1st Action** is selected.

Figure 2-8 - Example E



Camera Window

Figure 2-9 - Camera Window



After clicking **OK** on the System Settings dialog, the Camera Windows will appear for any camera set On. The title bar of the Camera Window will display the camera name and the location of the WMV video file if it is saving. If the camera's **Save Video** setting was not checked on the System Settings dialog, "Not recording…" will follow the camera name.

Toolbar Controls

Save **On** Toolbar

Save **Off** Toolbar

The camera window has several icons under the title bar in the toolbar. If the camera was set to Save Video in the System Settings dialog, there are three buttons. The first button starts and stops the saving. There are two buttons if the camera was not set to Save Video.

Stop/Start Saving Video

When the OK button is pressed on the System Settings dialog, any camera set to Save Video will start recording. So pressing this button for the first time on any Camera Window will stop the video from saving, but the live video stream will still be displayed in the Camera Window.

Snapshot Tool

The button that looks like a camera is the Snapshot tool. Press this button, and a still image will be saved in BMP format in the same directory specified as the "Saved Video Folder" on the System Settings dialog.

Camera Features

The right-most icon accesses the Camera Features dialog described in the System Settings section.

Annotation Toolbar

For cameras that are saving video, the Annotation Toolbar will appear at the right side of the Camera Window. The Annotation Toolbar is also applicable using the Playback Window, which may allow for more precise annotation placement. The Annotation Toolbar can be turned off via the main window's **View** menu. The Annotation Set specified in the System Settings dialog will be initially loaded, but may be changed by pulling down the list box at the upper right, as shown in Figure 2-10.

Figure 2-10 - Changing the Annotation Set

The name of the currently loaded Annotation Set is in the title bar of the annotation window ("Default" in Figure 2-10).

To annotate a video means to post descriptive text at a particular time, which will be seen as Closed Captioning during video playback. An annotation may be placed in a video during playback or recording.

Annotations may be applied using the mouse or keyboard. With the mouse, double click the text in the Annotation Bar with the left mouse button. Using the keyboard, press the indicated key combination, that is, hold down the Alt key then press the key specified next to the annotation.

To add an annotation to an Annotation Set, type the text in the box to the left of the annotation set pull-down list box, then press <Enter>.

To delete an annotation from a Annotation Set, highlight the behavior, and press the <DEL> or <Delete> key on your keyboard.

To create or delete an entire Annotation Set, refer to the "Add/Delete Annotation Set" section earlier in this manual.

Playback Window

To play a recorded video, select **Open** from the **File** menu, and choose the WMV file. The video will be opened in a Playback Window.

Figure 2-11 - Playback Window

The Playback Window plays saved videos, shows annotations, and adds new annotations. The video may be run at regular speed, or stepped through frame-by-frame. During playback, annotations will be displayed below the video. Annotations added during playback will be displayed in the lower pane of the Annotation toolbar.

Playback Controls

- Play/Pause button – starts or pauses the video from or at the current file position, as indicated in the file position scrollbar.
- Stop button – stops the playback, file location moves to first frame in video.
- Arrow keys – the keyboard left and right arrow keys can be used to move backward and forward while the video is paused, and the file position scrollbar control has the focus. The keyboard focus is indicated by a dotted line around the control. The arrow keys will move the video position one frame at a time.
- Repeat checkbox – to play the video in a continuous loop, fill this checkbox. If empty, the video will stop after the last frame.
- Go To Time button and time fields – to jump to specific time in the video, enter the hours (H), minutes (M) and seconds (S), then press the "Go To Time" button.
- Annotation Set button – to change the Annotation Set displayed in the Annotation toolbar, press the Annotation Set button, or use the pull-down list box in the Annotation toolbar.
- View Annotations button – displays a text file (which may be saved or printed) listing the annotations posted to the video file.
- File Position scrollbar – horizontal scrollbar shows the position of the currently displayed video frame in the video file. May be dragged with the cursor, or moved with the left and right keyboard arrow keys.
- Annotation display – annotations attached to the video file will be displayed in the text control below the File Position scrollbar.

Annotation Toolbar

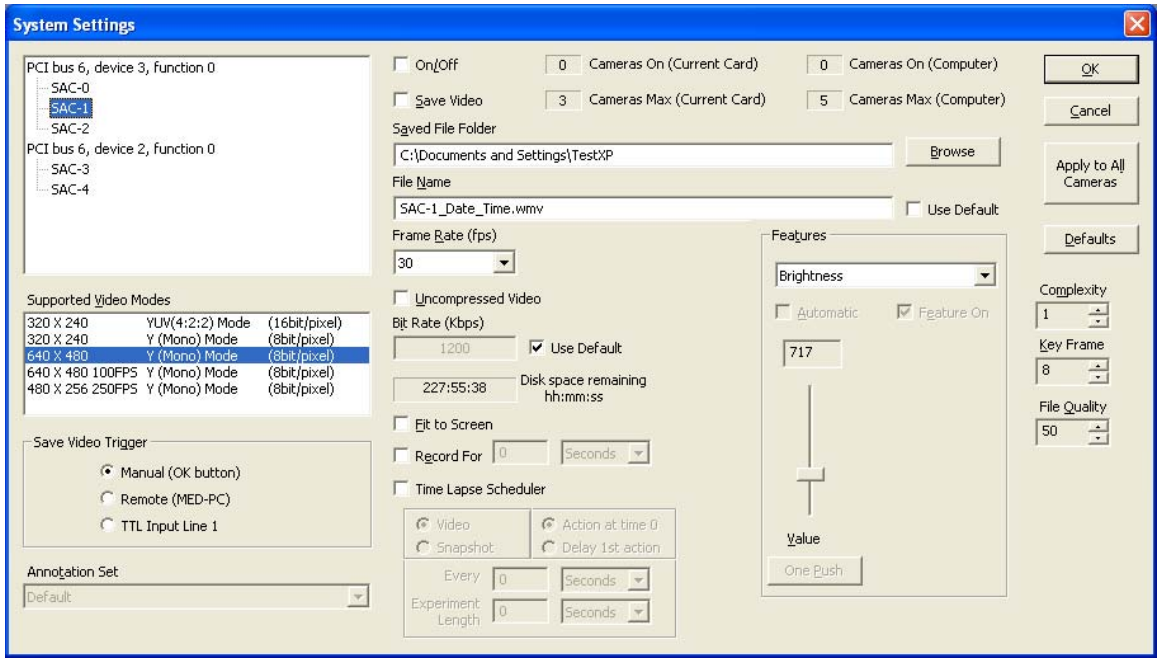
As described in the Camera Window section, Annotation Toolbar subsection, the Annotation Toolbar may be used during video playback to add text strings to a video clip. Any annotations added during video playback can be seen in the bottom pane of the Annotation Toolbar. Clicking the X at the top right of the toolbar, or pulling down the **View** menu and deselecting the Annotation Bar option will remove it from the Playback window. To jump to a specific annotation's time in the video, double click the annotation in the bottom pane (Posted Annotations) of the Annotation Toolbar.

CHAPTER 3
Using Video Monitor

Video Monitor is a flexible program; it can be used to view live video feeds, record video, and play back saved videos. To view or record live video, Video Monitor requires camera(s) to be properly configured with your system. See the "Installing & Configuring Hardware" section for more information.

When Video Monitor is started, the System Settings dialog is displayed. The dialog can also be accessed through the **File** menu. Use this dialog to turn on cameras, configure cameras, and set the video file storage locations.

Figure 3-1 - System Settings Screen



Configuring Cameras

A FireWire card has 314 Megabits per second maximum throughput. Throughput is calculated as:

Throughput = width * height * bit rate * frame rate

Where ***width*** is the Screen Resolution Width (pixels), ***height*** is Screen Resolution Height (pixels), ***bit rate*** is Stream Bit Rate (bits per pixel or "bpp"), and ***frame rate*** is the video recording rate (frames per second or "fps").

For example, a camera running in YUV 4:1:1 mode at 30 frames per second would use 640 pixels * 480 pixels * 12 bpp * 30 fps = 110,592,000 bits/sec. So only two cameras running at YUV 4:1:1, 30 fps could be run per FireWire card. To achieve more simultaneous video streams, use a less demanding video mode or a slower frame rate.

Remember that there are tradeoffs while setting up the Video Monitor system. Due to the data bandwidth constraints of the FireWire card(s), the computer PCI bus, and hard drive access restrictions, cameras may not operate properly at the highest frame rates, in the largest resolutions.

As a general rule, begin with the cameras set at the lowest acceptable resolution, slowest frame rate, and the default (or higher) bit rate. Then, make adjustments one field at a time until the optimum image, file quality and file size are achieved.

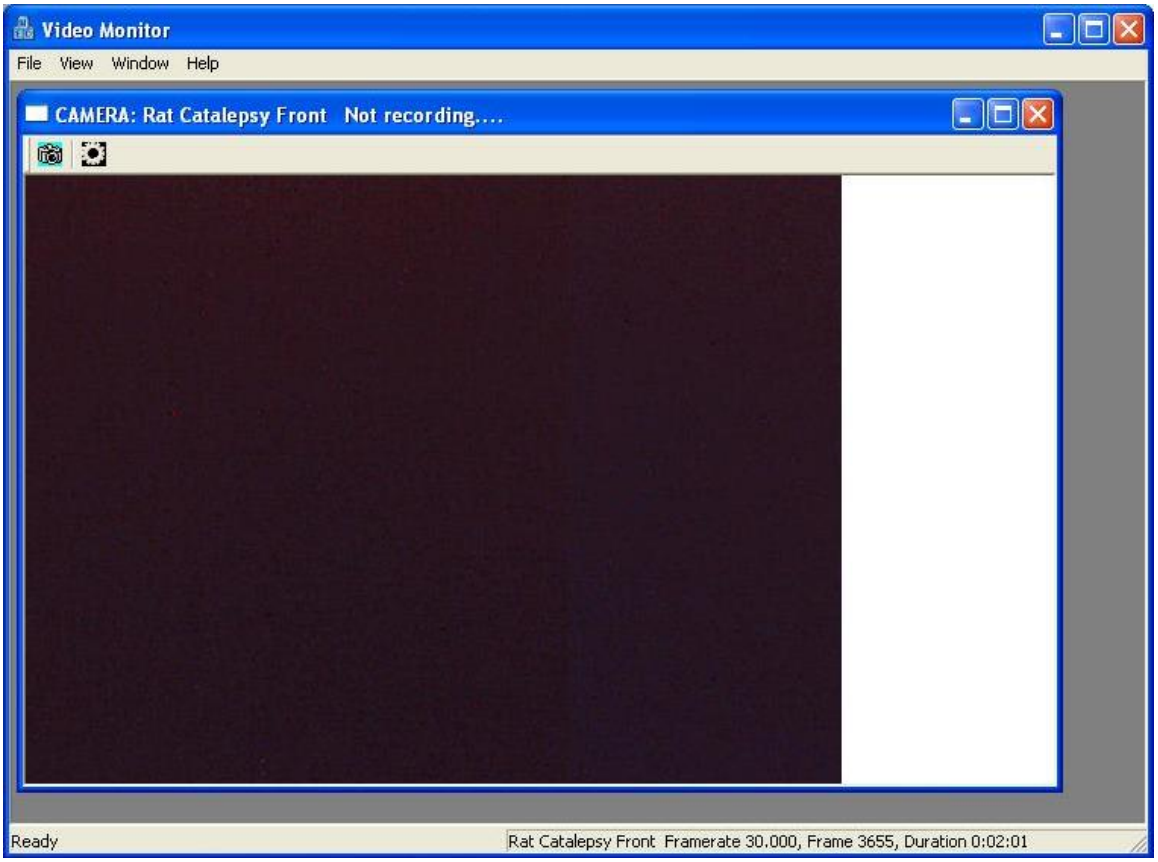
If the computer's processing and data transfer resources are exceeded, image frames will be lost or "dropped". If the video appears jerky, or the frame rate is uneven, first stop all other non-essential windows programs. Be especially aware of any scheduled events, such as a virus scan or disk defrag, that may occur during the experiment and affect the videos. Then, use a lower frame rate, or a smaller camera resolution, or a higher bit rate to achieve a smooth video stream.

Troubleshooting

"Black Screen"

If the Camera Window displays a completely black image, there are several possible causes. The problem could be an equipment issue with the camera or connection, or the problem lies within the camera's settings. Refer to the following lists and ensure that none of these problems are the cause.

Figure 3-2 - "Black Screen"


Video Monitor
File View Window Help
CAMERA: Rat Catalepsy Front Not recording....
Ready
Rat Catalepsy Front Framerate 30.000, Frame 3655, Duration 0:02:01

Equipment Issues

- Camera lens cap is on.
- Camera lens not properly attached to camera body.
- Camera lens aperture rotated to closed position.
- Loose FireWire cable connection at camera or computer.
- Light in Sound Attenuated Cubicle (or other closed environment) is out.
- Computer requires reboot.

Camera Settings

- Brightness level not set to automatic, and level is too low.
- Trigger set "On". This is the Camera Features Trigger, which is waiting for a pulse on the TTL switch signal line to begin frame exposure; not the remote trigger to begin recording from MED-PC.
- Auto Exposure level not set to automatic, and level is too low.
- Gain level not set to automatic, and level is too low.
- Shutter level not set to automatic, and level is too low.

Resolution

If all possible equipment issues have been eliminated, try setting all the camera features to "Automatic", if offered. Be sure the camera feature setting for Trigger is "Off". If the image is still black, use the "Defaults" button on the System Settings dialog to set everything to a "base" state.

Troubleshooting Video Capture

Video Monitor software is a computationally intensive system, and as such the physical limitations of the computer resources are stretched. Depending on the type of camera and settings being used, it is possible that the limits of the system could be exceeded. If this is the case, the following error messages may appear;

Failed to register the camera. GetLastError returned (#). This message indicates the system is unable to handle the current system settings for the number of cameras being used. Also, this error message may be seen if an unexpected error (such as a system crash) occurred while a camera was operating, and the camera was not properly shut down. Disconnect and reconnect the FireWire cable to the camera and restart Video Monitor to resolve.

Error. Out of memory. The computer is not fast enough or does not have enough memory to save this video. This message usually results from attempting to save video (usually uncompressed) data to disk faster than the computer can manage.

If either message is encountered, stop saving video and lower the frame rate. At a resolution of 640 x 480 most current systems can handle no more than fifteen frames per second with four cameras saving simultaneously, or two cameras at thirty frames per second. The options will depend upon which camera style is included with the system. Also try avoiding uncompressed video, increasing the bit rate (which will lower processor requirements for video compression) or decreasing camera resolution below 640 x 480.

In the event that the system "hangs", the most likely cause is a large backlog of hard disk operations. Either utilize Windows Task Manager to stop the program, or left-click on the Save Video button to stop saving. It may take a moment for the system to stop saving the video. If Task Manager is used to stop the program it is suggested that the system be restarted before continuing.

If the limits of the system are approached it is possible that frames will be "dropped" if the computer falls too far behind. A symptom of this is inconsistency between the displayed Duration of camera time and the timestamp on Annotations. The system has

been designed so that if this occurs, the saved video file will be of the correct duration and the Annotations file will also be correct.

Trigger from MED-PC

A MED-PC program can start and stop recording video by issuing commands to Video Monitor. The MED-PC code may be run on a different computer than the Video Monitor software, as long as the MED-PC computer can "see" the Video Monitor computer on the network. It is recommended, however, that MED-PC and Video Monitor run on the same computer.

There are four steps in the MED-PC procedure to save video with Video Monitor.

1. Open communication channel with Video Monitor.
2. Send command to begin recording.
3. Send command to end recording.
4. Close communication channel.

In detail:

1. To open the communication channel with Video Monitor, the MED-PC procedure issues a **ConnectToVM** or **ConnectToVMEx** command.

   ConnectToVM - takes two parameters: the Video Monitor computer name, and the camera name.

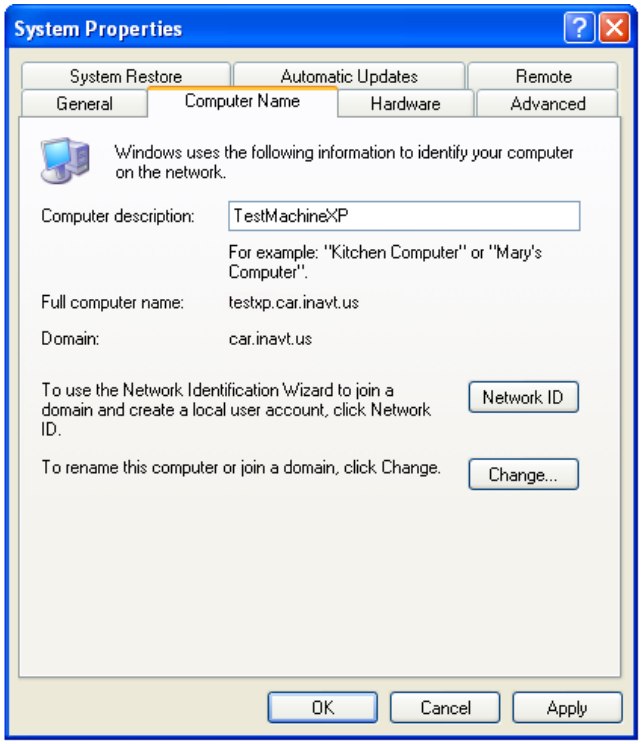
   Example: `ConnectToVM('testxp', 'SAC1')` opens communication with Video Monitor running on a computer called 'testxp', and a camera named 'SAC1'.

   ConnectToVMEx - provides error reporting back to MED-PC. ConnectToVMEx takes four parameters. In addition to the computer and camera name, ConnectToVMEx takes the MPCGlobal pointer, and BOX identifier. The MPCGlobal pointer is a pointer to MED-PC's internal data structures. BOX identifies which box is running the procedure. The MPCGlobal and BOX parameters provide Video Monitor a method to report errors back to MED-PC.

   Example: `ConnectToVMEx(MG, BOX, '.', 'CamA')` opens communication with Video Monitor running on the same computer as MED-PC (**'.'**), and a camera named "CamA". The MPCGlobal pointer is always referenced as "MG" and the Box identifier should always be referenced as "BOX".

   Note in the ConnectToVMEx example the Video Monitor program is run on the same computer as MED-PC, and therefore the computer name is "**.**". To find the Video Monitor computer name when using a two-computer setup, go to the **Start** menu, then **Control Panel**, open the **System** dialog, and then click the **Computer Name** tab. The computer name is the text before the first period on the "Full computer name" line. In the screen shot below, the computer name is "**testxp"**. Leave off the domain information (.car.inavt.us) when specifying this computer in the Med State Notation code.

Figure 3-3 – Finding Computer Name



When using the extended **ConnectToVMEx** connection protocol, connection errors are reported back to MED-PC. In the status bar of MED-PC, to the right of the date and time, the message "ERRORS! CHECK LOG!" will appear. Pull down the MED-PC **View** menu, and choose **Display Log**. The error log will have the Video Monitor communication error at or near the end of the file. **ConnectToVM does not** provide error reporting, **ConnectToVMEx** does provide error reporting.

2. The second step in the MED-PC code is to issue a **StartSavingEvent** command using the **WriteEventVM** function.

WriteEventVM - takes four parameters: the computer and camera names, as well as the event type, and any text to appear in the closed captioned portion of the recorded video. The possible event types are: **StartSavingEvent**, **PauseSavingEvent**, **StopSavingEvent**, or **GeneralEvent**. Start, Pause, and Stop are self-explanatory, use the **GeneralEvent** when you want the text specified in the fourth parameter to appear as a video annotation with no other actions.

Example: `WriteEventVM('.', 'Sac4', StartSavingEvent, 'Video Start')` tells Video Monitor to start saving on camera named "Sac4". The "." means Video Monitor is running on the same computer as MED-PC. The text "Video Start" will appear in the annotation portion of the recorded video.

Now that the camera has been started, begin your experiment commands. When done with the experiment and you are ready to stop recording video, the third and fourth commands should be issued.

3. Stop the video by writing a **StopSavingEvent** command using **WriteEventVM**.

   Example: `WriteEventVM('.', 'Sac4', StopSavingEvent, 'Video Stop')` tells Video Monitor to stop saving video on camera “Sac4”. The text “Video Stop” will appear in the annotation area of the saved video.

4. Close MED-PC to Video Monitor communication channel with **DisconnectVM.**

   Example: `DisconnectVM('.', 'Sac4')` commands Video Monitor to close its communication channel with MED-PC.

Basic MED-PC Triggering Example

Following is a basic example of triggering a camera using MED-PC code.

Start Trans IV

In Trans IV, create a new file and type in the Med State Notation below.

1. Pull down the Trans IV **File** menu and click **New**.
2. Enter program in Med State Notation. State 1 in the code below opens a communication channel with a camera named ‘Sac4’. The ‘.’ indicates Video Monitor is running on the same computer as the MED-PC software. To trigger Video Monitor running on a networked computer other than the computer running this Med State Notation, specify the computer name in place of ‘.’ below. State 2 starts saving video. State 3 stops the saving after 60 seconds. State 4 closes the communication channel.

```
S.S.1,
S1,
  1": ~ConnectToVM('.', 'Sac4');~ ---> S2

S2,
  2": ~WriteEventVM('.', 'Sac4', StartSavingEvent, 'Start Video');~ ---> S3

S3,
  60": ~WriteEventVM('.', 'Sac4', StopSavingEvent, 'Stop Video');~ ---> S4

S4,
  1": ~DisconnectVM('.', 'Sac4');~ ---> STOPKILL
```

3. Pull down the Trans IV **File** menu and click **Save As…**. Name the file VideoTest.MPC.
4. Open the Trans IV **Translation** menu, and choose **Translate and Compile**. Be sure MED-PC is NOT running before compiling.
5. In the **Specify Files to Translate** dialog, select the VideoTest.MPC file and click the **Make** button. Click the **OK** button to translate and compile the program.
6. Exit Trans IV.

Start Video Monitor

At the Video Monitor System Settings dialog, perform the following steps.

1. Select camera **Sac4** in the tree control.
2. Fill checkboxes for **On** and **Save**.
3. Select **Remote Trigger**.
4. Click **OK**.

The System Settings dialog will close and a window with camera Sac4's video stream will be displayed. The title bar will read, "Waiting for remote trigger…". Video Monitor is now properly configured to receive commands from MED-PC.

Start MED-PC

1. If MED-PC is running on a machine with no connected MED-PC hardware, select **No** at the warning dialog to run in Emulation mode.
2. If the Wizard starts, click **Close** to exit.
3. Pull down the MED-PC **File** menu, and choose **Open Session**.
4. In the Procedure combo box, select **VideoTest** (or name used in Step 3 of Trans IV section above).
5. Select **Box 1** as the only box to load.
6. Press **OK**.
7. Press **Close**.

The camera window title in Video Monitor will change from "Waiting for remote trigger…" to "CAMERA: Sac4 SAVING TO: XXXXX", where XXXXX is the location specified in the System Settings dialog Saved File Folder and File Name fields.

Extended MED-PC Triggering Example

For a more detailed MED-PC to Video Monitor communication example, see the Video.MPC procedure that ships with Video Monitor. This procedure uses the extended connection method **ConnectToVMEx**. The procedure also calls another useful function: **GetIfaceStatus**, to alter the course of the MED-PC procedure execution in case of an error during communication start up.

Video.MPC opens communication with MED-PC using the extended connection method, and checks the status of the communication before continuing. If the communication is OK, a 10 second video is recorded. If the communication fails, an error will be reported to the MED-PC session log, and the Video.MPC procedure exits.

```
\ Copyright (C) 2008 MED Associates, All rights reserved.

\ Video.mpc
\
\ Assigns MED_VM_Interface.dll Connection constants (defined in VM_Iface.hed)
\ to local array "Q".
\
\ Attempts connection with VideoMonitor over LAN (Domain or Workgroup).
\ If it does not connect, it retries every 1/10 second.
\ If it connects with Video Monitor, a Video is recorded for 10 seconds, then
\   the connection is terminated.
```

```
\ List Working Variables Here
\  Q() = Array holds MED-VM Interface Connections Status States
\  Q(0) = Unconnected
\  Q(1) = Good Connection
\  Q(2) = FAILED Connection
\
\  X = Video Monitor Connection Status


DIM Q = 2


\************************************************
\                   MAIN PROGRAM
\************************************************
S.S.1,
S1,
  1": ~Q[0] := UNCONNECTED;
       Q[1] := CONNECT_OK;
       Q[2] := CONNECT_FAIL;
      ConnectToVMEx(MG, BOX, '.', 'Cam');~;
      SHOW 3,Unconnected =,Q(0), 4,Connected =,Q(1), 5,Failure =,Q(2) ---> S2

S2,     \ Attempt connection with VideoMonitor
        \ X is Interface Status Value from MED_VM_Interface.dll
  0.1": ~X := GetIfaceStatus();~;
        SHOW 2,Status:,X;
        IF X = Q(0) [@NotConnected, @Next]
           @NotConnected: SHOW 1,Not Connected,0 ---> S2
           @Next: IF X = Q(1) [@Connected, @Next]
                     @Connected: SHOW 1,Connected OK,1 ---> S3
                     @Next: IF X = Q(2) [@Failed, @Unknown]
                               @Failed:  SHOW 1,Connection Failed,0 ---> S6
                               @Unknown: SHOW 1,Unknown State,0 ---> S6

S3,     \ Send command to Start Saving Data
  1": ~WriteEventVM('.', 'Cam', StartSavingEvent, 'StartEvent');~ ---> S4

S4,     \ Send command to Stop Saving Data
  10": ~WriteEventVM('.', 'Cam', StopSavingEvent, 'StopEvent');~ ---> S5

S5,     \ Disconnect from VideoMonitor
  0.01": ~DisconnectVM('.', 'Cam');~ ---> S6

S6,
  0.01":  ---> STOPKILL
```

CHAPTER 4
Hardware, Driver and Software Installation

Computer systems purchased from MED Associates have all hardware, drivers and software installed and configured prior to customer's receipt. In the event of a system failure, e.g. hard drive crash, the software and/or hardware may need to be installed on another machine, or reinstalled.

The hardware required by Video Monitor software is a FireWire card installed in the computer, and cameras connected to that card. The required software is all included on the Video Monitor CD.

Installing Video Monitor Software

When purchasing a Video Monitor system from Med Associates, a computer will be shipped with the software already installed. To re-install the software, insert the Video Monitor CD, and the screen shown in Figure 4-1 will appear. Click on **Install Video Monitor software** and the screen shown in Figure 4-2 will appear.

Figure 4-1 - Video Monitor Installation Screen

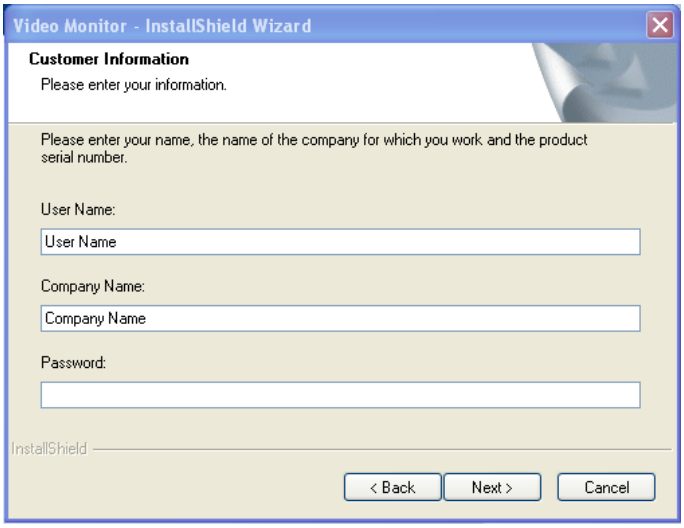
Click **Install** to begin installation of the Fire Wire Camera Driver and the Video Monitor software. A successful installation will be indicated by a green check mark, and a red X will indicate unsuccessful installation. Please contact MED Associates Customer Support if any portion of the installation is unsuccessful.

Figure 4-2 - Customer Information Screen

Video Monitor Install Wizard
med associates inc
Welcome to the install wizard for Video Monitor
The wizard will install Video Monitor on your computer. To continue, click Install.
Fire Wire Camera Driver
Video Monitor
instrumentation and software for research
Install
Cancel

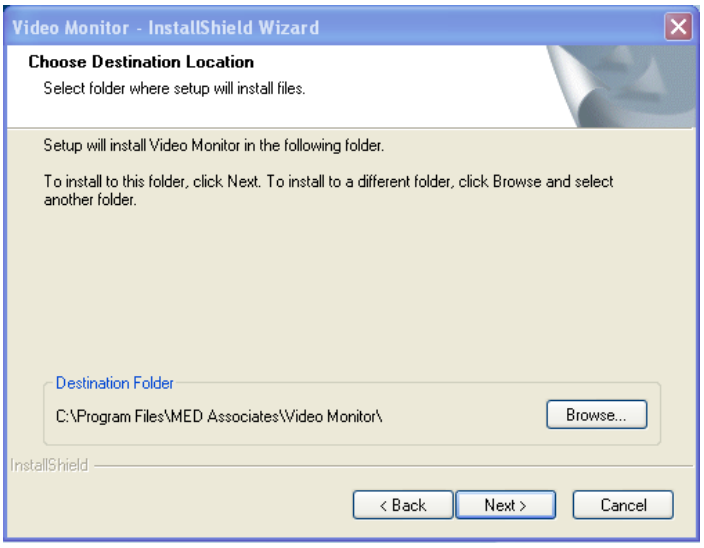
Once the Fire Wire Camera Driver has been successfully installed, the screen shown in Figure 4-3 will appear. Enter the desired User Name and Company Name. MED Associates issues the password when the Software Registration form is submitted. Click **Next** to continue and the screen shown in Figure 4-4 will appear.

Figure 4-3 – Customer Information



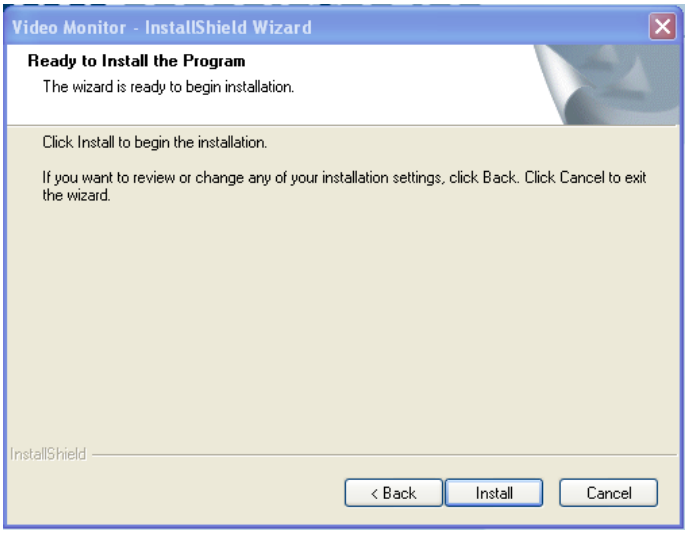
The default destination folder is shown. If this folder is acceptable, click **Next** to continue and the screen shown in Figure 4-5 will appear. If it is not, click **Browse…** and browse to the desired folder.

Figure 4-4 – Choose Destination Location


Video Monitor - InstallShield Wizard
Choose Destination Location
Select folder where setup will install files.
Setup will install Video Monitor in the following folder.
To install to this folder, click Next. To install to a different folder, click Browse and select another folder.
Destination Folder
C:\Program Files\MED Associates\Video Monitor\
Browse...
InstallShield
< Back
Next >
Cancel

If all of the information entered was corrected, click **Install** to complete the Video Monitor software installation. The screen shown in Figure 4-6 will appear.

Figure 4-5 – Ready to Install the Program


Video Monitor - InstallShield Wizard
Ready to Install the Program
The wizard is ready to begin installation.
Click Install to begin the installation.
If you want to review or change any of your installation settings, click Back. Click Cancel to exit the wizard.
InstallShield
< Back
Install
Cancel

The Fire Wire Camera Driver and Video Monitor installation is now complete. Click **Finish** to close this screen.

Figure 4-6 – Installation Complete

Hardware Installation

Installing the FireWire PCI Card

Always turn off power to the computer prior to installing the FireWire card. Neglecting this precaution may cause serious damage. Install the FireWire card in any available PCI slot, following the directions provided with the computer for installing a PCI card.

Installing the FireWire PCMCIA Card

Plug the FireWire card into any available PCMCIA slot on the laptop.

Installing the FireWire Cameras

Using the included FireWire cable, plug the first camera into any FireWire port on the FireWire PCI/PCMCIA card. Then plug the second camera into any FireWire port on the FireWire PCI/PCMCIA card (alternatively, you may plug the second camera into the back of the first camera). Note that only two cameras can be plugged into a FireWire card when using a resolution of 640x480, at 30FPS (frames per second). In order to use three or four cameras, a second FireWire card must be installed. Cameras three and four must then be plugged into the second FireWire card. Once the cameras are plugged into the computer, the appropriate driver must be installed.

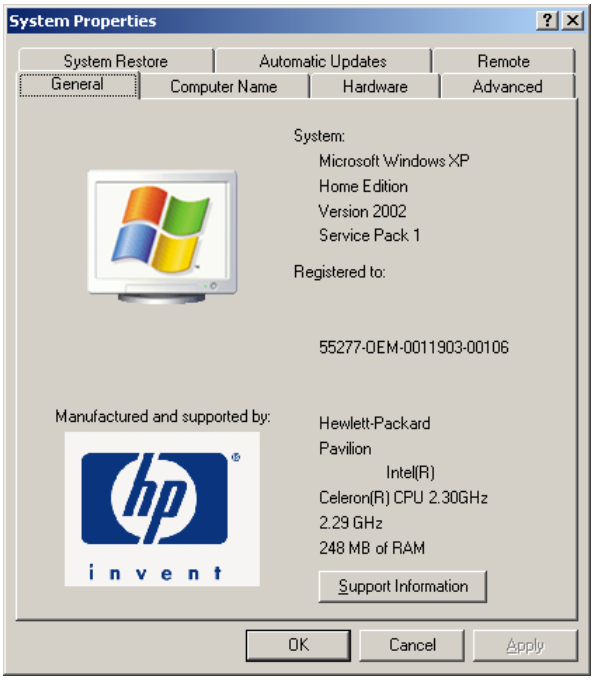
Installing the FireWire Camera Driver

Right-click on the **My Computer** icon, then click **Properties** as shown in Figure 4-7.

Figure 4-7 – My Computer Properties

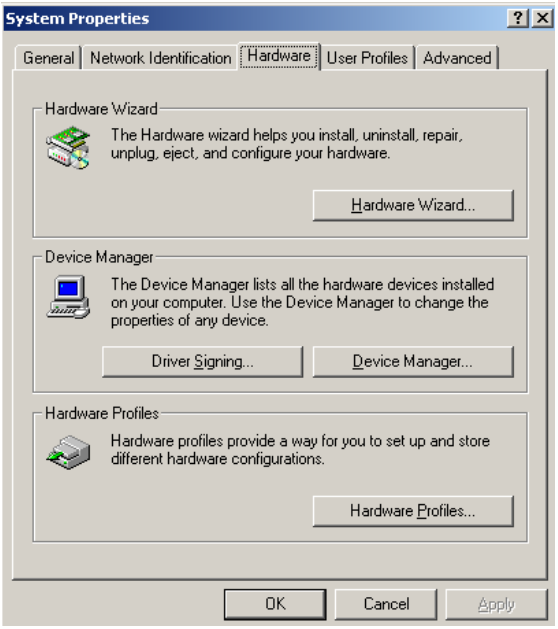
When Figure 4-8 appears, click the **Hardware** tab.

Figure 4-8 - System Properties



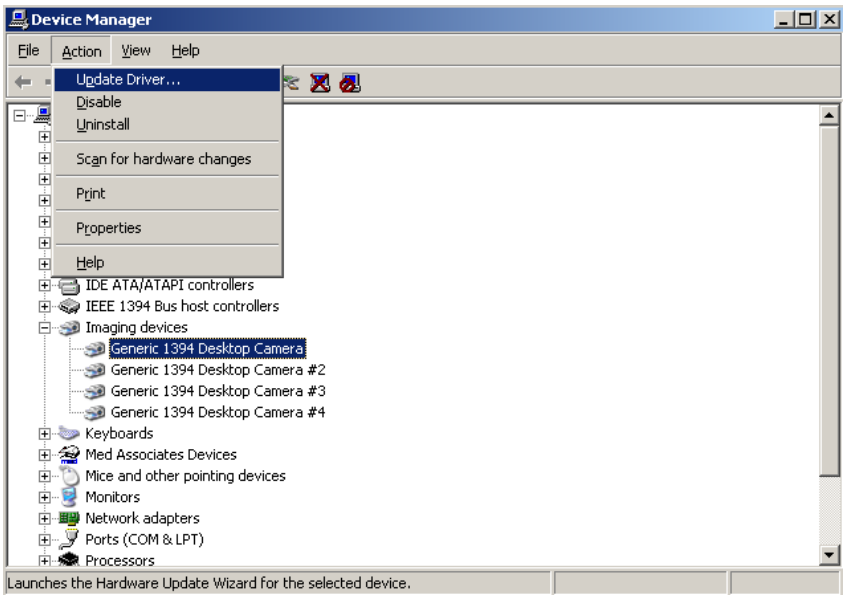
Now click on the **Device Manager** button, see Figure 4-9.

Figure 4-9 - Device Manager


System Properties
General
Network Identification
Hardware
User Profiles
Advanced
Hardware Wizard
The Hardware wizard helps you install, uninstall, repair, unplug, eject, and configure your hardware.
Hardware Wizard...
Device Manager
The Device Manager lists all the hardware devices installed on your computer. Use the Device Manager to change the properties of any device.
Driver Signing...
Device Manager...
Hardware Profiles
Hardware profiles provide a way for you to set up and store different hardware configurations.
Hardware Profiles...
OK
Cancel
Apply

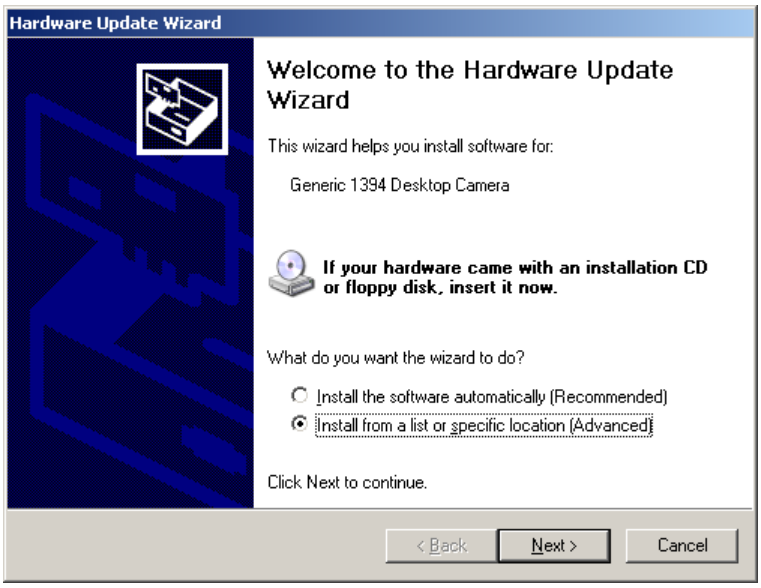
Click on the **Imaging Devices** icon, and each camera that is plugged in should show up as a "Generic 1394 Desktop Camera". Select the first camera, and then go to **Action | Update Driver** as shown in Figure 4-10.

Figure 4-10 - Imaging Devices



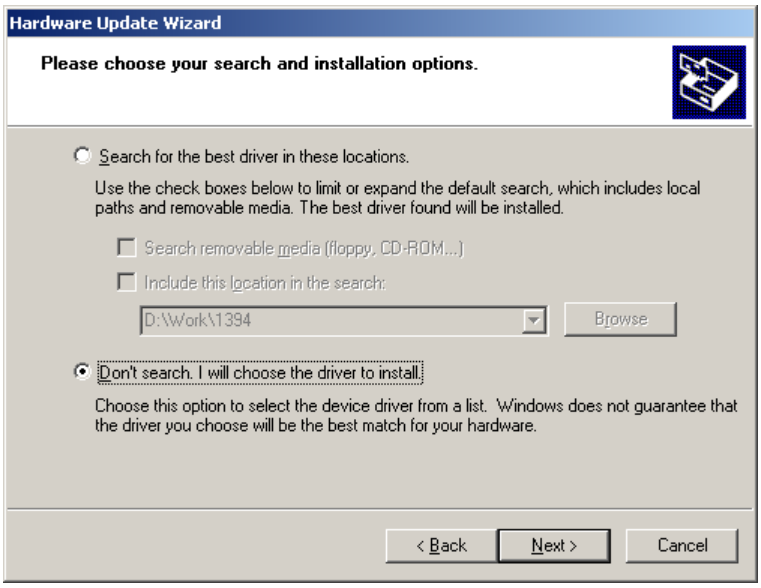
Select **Install from a list or specific location (Advanced)**, and then click **Next**.

Figure 4-11 - Install from a list or specific location (Advanced)


Hardware Update Wizard
Welcome to the Hardware Update Wizard
This wizard helps you install software for:
Generic 1394 Desktop Camera
If your hardware came with an installation CD or floppy disk, insert it now.
What do you want the wizard to do?
Install the software automatically (Recommended)
Install from a list or specific location (Advanced)
Click Next to continue.
< Back
Next >
Cancel

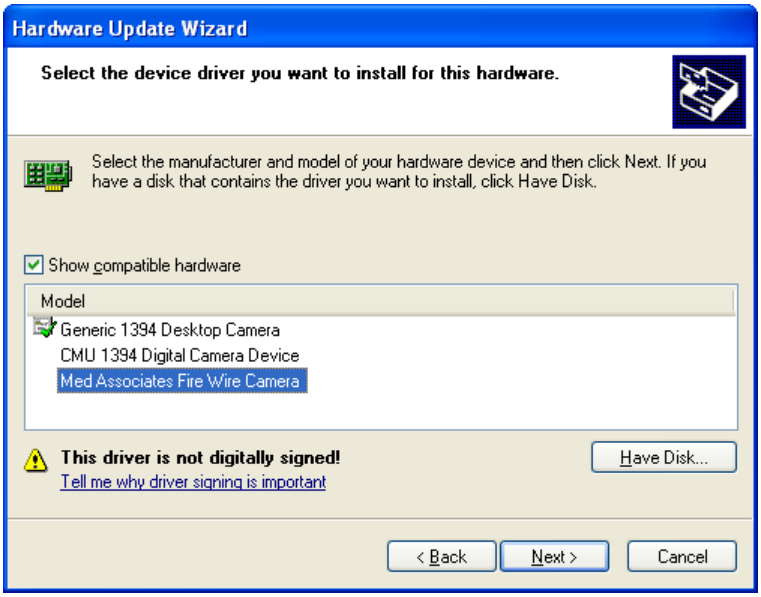
When Figure 4-12 appears select **Don't search. I will choose the driver to install** and click **Next**.

Figure 4-12 - Don't search. I will choose the driver to install.


Hardware Update Wizard
Please choose your search and installation options.
Search for the best driver in these locations.
Use the check boxes below to limit or expand the default search, which includes local paths and removable media. The best driver found will be installed.
Search removable media (floppy, CD-ROM...)
Include this location in the search:
D:\Work\1394
Browse
Don't search. I will choose the driver to install.
Choose this option to select the device driver from a list. Windows does not guarantee that the driver you choose will be the best match for your hardware.
< Back
Next >
Cancel

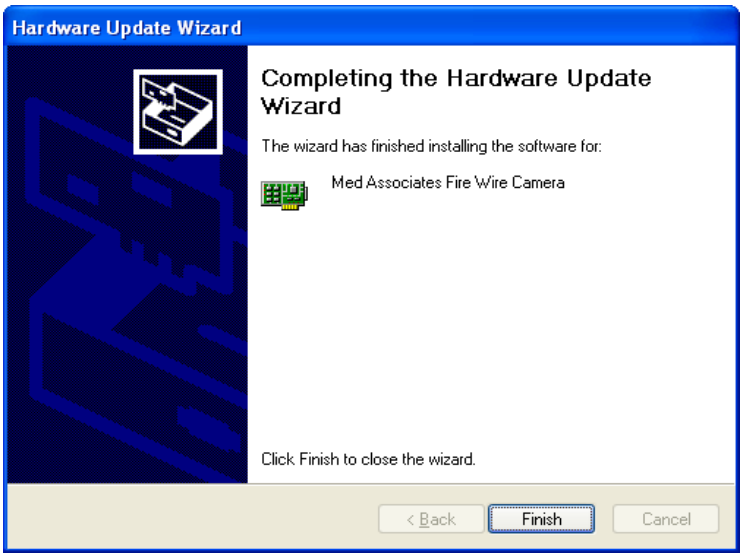
When Figure 4-13 appears select the **Med Associates Fire Wire Camera** and press the **Next** button.

Figure 4-13 - MED Associates Fire Wire Camera


Hardware Update Wizard
Select the device driver you want to install for this hardware.
Select the manufacturer and model of your hardware device and then click Next. If you have a disk that contains the driver you want to install, click Have Disk.
Show compatible hardware
Model
Generic 1394 Desktop Camera
CMU 1394 Digital Camera Device
Med Associates Fire Wire Camera
This driver is not digitally signed!
Tell me why driver signing is important
Have Disk...
< Back
Next >
Cancel

Click on the **Finish** button. The MED Associates FireWire Camera driver has now been installed.

Figure 4-14 - Installation Complete



NOTE: This procedure must be repeated for each camera that is plugged in. When repeating the procedure, please refer to Figure 4-13.